

Volume 61 of PROCEEDINGS includes the papers presented at the scientific conference RU & SU'22, organized and conducted by University of Ruse "Angel Kanchev" and the Union of Scientists - Ruse. Series 4.1. contains papers reported in the Transport and Machine Science section.

Book	Code	Faculty and Section
Agrarian and Industrial Faculty		
1.1.	FRI-8.303b-1-AMT&ASVM	Agricultural Machinery and Technologies, Agrarian Science and Veterinary Medicine
	FRI-1.202-1-MR	Maintenance and Reliability
	FRI-9.2-1-THPE	Thermal, Hydro- and Pneumatic Equipment
	FRI-19.206-1-EC	Ecology and Conservation
	FRI-16.203-1-ID	Industrial Design
1.2.	THU-SSS-AMT&ASVM	Agricultural Machinery and Technologies, Agrarian Science and Veterinary Medicine
	THU-SSS-MR	Maintenance and Reliability
	THU-SSS-THPE	Thermal, Hydro- and Pneumatic Equipment
	THU-SSS-EC	Ecology and Conservation
	THU-SSS-ID	Industrial Design
Faculty of Mechanical and Manufacturing Engineering		
2.1.	FRI-1.317-1-MEMBT	Mechanical Engineering and Machine-Building Technologies
2.2.	WED-1.417-SSS-MEMBT	Mechanical Engineering and Machine-Building Technologies
Faculty of Electrical Engineering Electronics and Automation		
3.1.	FRI-10.326-1-EEEEA	Electrical Engineering, Electronics and Automation
3.2.	FRI-2G.303-1-CCT	Communication and Computer Technologies
3.3.	THU-SSS-EEEEA	Electrical Engineering, Electronics and Automation
	THU-SSS-CCT	Communication and Computer Technologies
Faculty of Transport		
4.1.	FRI-2.209-1-TMS	Transport and Machine Science
4.2.	FRI-2.204-SITSTL	Sustainable and Intelligent Transport Systems, Technologies and Logistics
4.3.	WED-ONLINE-SSS-TMS	Transport and Machine Science
Faculty of Business and Management		
5.1.	FRI-2B.412-1-EM1	Economics and Management
5.3.	THU-2G404-SSS-EM	Economics and Management
5.4.	FRI-2G.510-1-ESIS	European Studies and International Security
8.2.	FRI-1.322-1-SW	Social Work
Faculty of Natural Sciences and Education		
6.1.	FRI-1.414-MIP	Mathematics, Informatics and Physics
6.2.	FRI-2G.405-PP	Pedagogy and Psychology
6.3.	FRI-2G.408-SSS-LLA	Linguistics, Literature and Art Science & History, Ethnology and Folklore
6.4.	FRI-2.116-ERI	Education - Research and Innovations
6.5.	FRI-2.204-SSS-FM	Financial Mathematics
	FRI-1.307-SSS-PP	Pedagogy and Psychology

Faculty of Law		
7.1.	FRI-2B.313-1-L	Law Studies
7.2.	FRI-2B.312-1-NS	National Security
7.3.	THU-2B313-SSS-L	Law Studies
Faculty of Public Health and Health Care		
8.1.	FRI-2K.201-1-HP	Health Promotion
8.3.	FRI-2G.104-1-HC	Health Care
8.4.	FRI-2G.309-1-MCDA	Medical and Clinical Diagnostic Activities
8.5.	THU-ONLINE-SSS-HP	Health Promotion
	FRI-2-101-SSS-HC	Health Care
	THU-SSS-MCDA	Medical and Clinical Diagnostic Activities
Quality of Education Directorate		
9.1.	FRI-K1-1-QHE	Quality of Higher Education
Razgrad Branch of the University of Ruse		
10.1.	FRI-LCR-1-CT(R)	Chemical Technologies
10.2.	FRI-LCR-1-BFT(R)	Biotechnologies and Food Technologies
10.3.	TUE-SSS-BFT(R)	Biotechnologies and Food Technologies
	TUE-SSS-CT(R)	Chemical Technologies
Silistra Branch of the University of Ruse		
11.1.	FRI-239-1-PPM(S)	Pedagogy; Psychology and Methodology of training in ...
	FRI-110-1-PP(S)	Philology and Philosophy
	FRI-216-1-ITS(S)	IT and Technical Sciences
11.2.	FRI-110-2-SSS-PP(S)	Philology and Philosophy
	FRI-216-2-SSS-ITS(S)	IT and Technical Sciences

The papers have been reviewed.

ISSN 1311-3321 (print)

ISSN 2535-1028 (CD-ROM)

ISSN 2603-4123 (on-line) Copyright © authors

The issue was included in the international ISSN database, available at <https://portal.issn.org/>.

The online edition is registered in the portal ROAD scientific resources online open access



PROGRAMME COMMITTEE

- **Prof. Amar Ramdane-Cherif**
University of Versailles, France
- **Assoc. Prof. Manolo Dulva HINA**
ECE Paris School of Engineering, France
- **Prof. Leon Rothkrantz**
Delft University of Technology, Netherlands
- **Assoc. Prof. Antonio Jose Mendes**
University of Coimbra, Portugal
- **Prof. Ville Leppanen**
University of Turku, Finland
- **Assoc. Prof. Marco Porta**
University of Pavia, Italy
- **Prof. Douglas Harms**
DePauw University, USA
- **Prof. Zhanat Nurbekova**
L. N. Gumilyov Eurasian National University, Nur Sultan, Kazakhstan
- **Prof. Mirlan Chynybaev**
Kyrgyz State Technical University, Bishkek, Kyrgyzstan
- **Prof. Ismo Hakala, PhD**
University of Jyväskylä, Finland
- **Prof. Artur Jutman, PhD**
Tallinn University of Technology, Estonia
- **Prof. RNDr. Vladimir Tvarozek, PhD**
Slovak University of Technology in Bratislava, Bratislava, Slovakia
- **Assoc. Prof. Ing. Zuzana Palkova, PhD**
Slovak University of Agriculture in Nitra, Nitra, Slovakia
- **Andrzej Tutaj, PhD**
AGH University of Science and Technology, Krakow, Poland
- **Prof. Valentin NEDEFF Dr. eng. Dr.h.c.**
“Vasile Alecsandri” University of Bacău, Romania
- **Cătălin POPA, PhD**
“Mircea cel Bătrân” Naval Academy, Constantza, Romania
- **Prof. dr Larisa Jovanović**
Alfa University, Belgrade, Serbia
- **Prof. dr hab. Edmund LORENCOWICZ**
University of Life Sciences in Lublin, Poland
- **Assoc. Prof. Ion MIERLUS - MAZILU, PhD**
Technical University of Civil Engineering, Bucharest, Romania
- **Prof. Dojčil Vojvodić PhD**
Faculty of Philosophy, University of Novi Sad, Serbi
- **Assoc. Prof. Alexandrache Carmen, PhD**
Department of Teacher Training, “Dunarea de Jos”, Galati University, Romania
- **Prof. Alberto Cabada**
University of Santiago de Compostela, Faculty of Mathematics, Santiago de Compostela, Spain
- **Kamen Rikev, PhD**
Institute of Slavic Philology, Maria Curie-Skłodowska University in Lublin, Poland

- **Anna Klimentova, PhD**
Constantine the Philosopher University of Nitra, Slovakia
- **Prof. Ricardo Gobato, PhD**
Secretariat of State of Parana Education and Sport (SEED/PR), Laboratory of Biophysics and Molecular Modeling Genesis
- **Prof. Fatima Rahim Abdul Hussein, PhD**
University of Misan, College of Basic Education, English Department, Iraq
- **Prof. Emilija Gjorgjeva, PhD**
Goce Delchev University - Shtip, Nord Macedonia
- **Prof. Igor Kevorkovich Danilov, DSc**
Yuri Gagarin State Technical University of Saratov, Russia
- **Prof. Aleksander Valentinov Sladkowski, DSc**
Silesian University of Technology, Poland
- **Prof. Vera Karadjova, PhD**
“St. Kliment Ohridski” University – Bitola, Faculty of tourism and hospitality – Ohrid, Republic of North Macedonia
- **Prof. Aleksandar Trajkov, PhD**
“St. Kliment Ohridski” University - Bitola, Faculty of tourism and hospitality – Ohrid, Republic of North Macedonia
- **Prof. Petar Pepur, PhD**
University of Split, Croatia
- **Prof. Korhan Arun, PhD**
Namik Kemal University, Tekirdağ, Turkey
- **Prof. Yuliya Yorgova, PhD**
Burgas Free University, Bulgaria
- **Jelena Stankovic, PhD**
University of Nis, Serbia
- **Jovica Stankovic, PhD**
University of Nis, Serbia
- **Prof. Gerhard Fiolka, PhD**
University of Fribourg, Switzerland
- **Prof. Haluk Kabaalioglu, PhD**
Yeditepe University, Turkey
- **Prof. Silva Alves, PhD,**
University of Lisbon, Portugal
- **Hanneke van Brugge, DHC mult**
Appeldoorn, The Netherlands
- **Prof. Elena Torina**
Tula State Pedagogical University "L. N. Tolstoy", Tula, Russia
- **Prof. Violeta Jotova**
Direction Pediatrics at St. Marina University Hospital - Varna, Bulgaria, Chair ESPE Postgraduate Qualification Committee
- **Prof. Tanya Timeva, MD, PhD**
Obstetrics and Gynecology Hospital "Dr. Shterev", Sofia, Bulgaria
- **Prof. Kiril Stoychev, DSc,**
University of National and World Economy, Bulgaria
- **Assoc. Prof. Mark Shamtsyan, PhD**
Technical University, Saint Petersburg, Russia

- **Assoc. Prof. Oleksii Gubenia, PhD**
National University of Food Technologie, Kiev, Ukraine
- **Prof. Olexandr Zaichuk, DSc**
Ukrainian State University of Chemical Technology, Dnepropetrovsk, Ukraine
- **Prof. Eugene Stefanski, DSc**
Samara University, Russia
- **Assoc. Prof. Tatiana Strokovskaya, PhD**
International University of Nature “Dubna”, Dubna, Russia
- **Prof. DSc. Petar Sotirow**
Maria Curie-Sklodowska University of Lublin, Poland
- **Prof. Papken Ehasar Hovsepian**
Sheffield Hallam University, Sheffield, UK
- **Accos. Prof. Krassimir Dochev Dochev, PhD**
University of Portsmouth School of Engineering, UK
- **Mariana Yordanova Docheva, PhD**
University of Portsmouth School of Engineering, UK
- **Assoc. Prof. Ivan Antonov Lukanov, PhD**
University of Botswana, Faculty of Engineering and Technology, Gaborone, Botswana
- **Assoc. Prof. Petko Vladav Petkov, PhD**
Research Associate Cardiff University, UK
- **Prof. Stepan Terzian DSc**
Bulgarian Academy of Science, Bulgaria
- **Prof. Gabriel Negreanu, PhD**
University Politehnica of Bucharest, Romania

ORGANISING COMMITTEE

◆ **ORGANIZED BY: UNIVERSITY OF RUSE (UR) AND UNION OF SCIENTISTS (US) - RUSE**

◆ **ORGANISING COMMITTEE:**

• **Chairperson:**

Acad. DTSc. Hristo Beloev, DHC mult., Academician of Bulgarian Academy of Sciences - Rector of UR, Chairperson of US - Ruse

• **Scientific Secretary:**

Prof. Diana Antonova DSc, Head of a University Scientific Research Complex
dantonova@uni-ruse.bg, 082/888 249

• **THEMATIC FIELDS:**

- **Agricultural Machinery and Technologies, Agrarian Sciences and Veterinary Medicine**
- **Maintenance and Reliability**
- **Thermal, Hydro- and Pneumatic Equipment**
- **Ecology and Conservation**
- **Industrial Design**
Assoc. Prof. Plamen Manev,
pmanev@uni-ruse.bg, 082 888 485
- **Pedagogy; Psychology and Methodology of training in...; (27-28.10, Silistra)**
Assoc. Prof. Galina Lecheva, PhD,
glecheva@uni-ruse.bg, +359 88 540 0647
- **Philology and Philosophy; (27-28.10, Silistra)**
Assoc. Prof. Todorka Georgieva, DcS
tgeorgieva@uni-ruse.bg, +359887800271
- **IT and Technical Sciences; (27-28.10, Silistra)**
Assoc. Prof. Evgenia Goranova, PhD,
egoranova@uni-ruse.bg, +359887411590
- **Chemical Technologies (04-05.11., Razgrad)**
- **Biotechnologies and Food Technologies (04-05.11., Razgrad)**
Assoc. Prof. Tsvetan Dimitrov, PhD,
conf_rz@abv.bg, 0887 631 645
- **Mechanical Engineering and Machine-building Technologies**
Prof. Ivelin Ivanov, PhD
ivivanov@uni-ruse.bg, +359 82 888 472
- **Electrical Engineering, Electronics and Automation**
Assoc. Prof. Boris Evstatiev, PhD,
bevstatiev@uni-ruse.bg, 082 888 371
- **Communication and Computer Systems**
Assoc. Prof. Galina Ivanova, PhD, giivanova@uni-ruse.bg, 082 888 855
- **Transport and Machine Science**
Assoc. Prof. Simeon Iliev, PhD,
spi@uni-ruse.bg, 082 888 331

- **Sustainable and intelligent transport systems, technologies and logistics**
Prof. Velizara Pencheva, PhD,
vpencheva@uni-ruse.bg, 082 888 558, 082 888 608
- **Economics and Management**
Pr. Assist. Miroslava Boneva, PhD, mboneva@uni-ruse.bg, 082/888 776
Pr. Assist. Elizar Stanev, PhD, eastanev@uni-ruse.bg, 082/888 557
- **Social Work**
Pr. Assist. Ana Popova, PhD,
apopova@uni-ruse.bg, 0889 874219
- **European studies and International Security**
Prof. Vladimir Chukov, DSc, vlachul@gmail.com, +359 82 825 667
Assoc. Prof. Mimi Kornazheva, PhD, mkornazheva@uni-ruse.bg, +359 82 825 667
- **Mathematics, Informatics and Physics**
Prof. Tsvetomir Vasilev, PhD,
tvasilev@uni-ruse.bg, 082/888 475
- **Education – Research and Innovations**
Assoc. Prof. Emilia Velikova, PhD,
evelikova@uni-ruse.bg, 0885 635 874
- **Pedagogy and Psychology**
Assoc. Prof. Bagryana Ilieva, PhD,
bilieva@uni-ruse.bg 082 888 219
- **History, Ethnology and Folklore**
Pr. Assist. Reneta Zlateva, PhD
rzlateva@uni-ruse.bg, 082/888 752
- **Linguistics, Literature and Art Science**
Assoc. Prof. Velislava Doneva, PhD,
doneva_v@uni-ruse.bg, 0886 060 299
- **Health Promotion**
Assoc. Prof. Stefka Mindova, PhD,
smindova@uni-ruse.bg, 0882 895 149
- **Medical and Clinical Diagnostic Activities**
Chief Assist. Denitsa Trancheva
dtrancheva@uni-ruse.bg, 0883 342 616
- **Health Care**
Assoc. Prof. Tsveta Hristova, PhD,
tshristova@uni-ruse.bg, 0878 389 793
- **Law**
Assoc. Prof. Elitsa Kumanova, PhD,
ekumanova@uni-ruse.bg, 0884 980 050
- **National Security**
Assoc. Prof. Milen Ivanov, DSc,
poligon@abv.bg, 082 888 736
- **Quality of Higher Education**
Prof. Ivanichka Serbezova, PhD, iserbezova@uni-ruse.bg
Daniela Todorova, dtodorova@uni-ruse.bg, 082 888 378

- **REVIEWERS**

Prof. Emil Marinov, PhD

Assoc. Prof. Vasko Dobrev, PhD

Assoc. Prof. Radostin Dolchinkov, PhD

Assoc. Prof. Radostin Dimitrov, PhD

ELECTRICAL ENGINEERING, ELECTRONICS AND AUTOMATION

Content

1. FRI-2.206-1-TMS-01	12
Personal effectiveness and scientific productivity of doctoral students <i>Vyarka Ronkova, Antoaneta Dobрева</i>	
2. FRI-2.206-1-TMS-02	18
Integration of cad systems in the digitalization process in the conditions of remote work and industry 4.0 <i>Yuliyana Dimitrov</i>	
3. FRI-2.206-1-TMS-03	24
Comparative analysis of specific capabilities of cad systems for design <i>Yordanka Dimitrova, Yuliyana Dimitrov</i>	
4. FRI-2.206-1-TMS-04	29
Students in engineering bachelor courses and their preliminary general technical background <i>Diana Nikolaeva, Vyarka Ronkova</i>	
5. FRI-2.206-1-TMS-05	34
Students in engineering bachelor courses and their preliminary general technical background <i>Diana Nikolaeva, Vyarka Ronkova</i>	
6. FRI-2.206-1-TMS-06	39
Students in engineering bachelor courses and their preliminary general technical background <i>Tsvetomir Gechev, Plamen Punov, Dalibor Barta</i>	
7. FRI-2.206-1-TMS-07	48
Used on refrigerant pressure in automotive air conditioning systems as a diagnostic parameter <i>Georgi Kadikyanov, Rosen Ivanov, Gergana Staneva, Iliyana Minkovska</i>	
8. FRI-2.206-1-TMS-08	53
Live cycle assesment of vehicle lithium-ion batteries <i>Angel Dyndikov, Ivan Evtimov, Rosen Ivanov</i>	
9. FRI-2.206-1-TMS-09	60
Comparative study of energy consumption and ecological impact of main types of cars <i>Krasimir Kirilov, Ivan Evtimov, Rosen Ivanov</i>	
10. FRI-2.206-1-TMS-10	68
Study of energy consumption of a central drive electric bicycle on a route <i>Nikolay Dimitrov, Rosen Ivanov, Ivan Evtimov</i>	
11. FRI-2.206-1-TMS-11	74
Comparative study of energy consumption of two types electric bicycle on a route <i>Nikolay Dimitrov, Rosen Ivanov, Ivan Evtimov</i>	
12. FRI-2.206-1-TMS-12	80
Main problems with the recycling of railway sleepers types <i>Ivan Omayiski, Rosen Ivanov</i>	

13. FRI-2.206-1-TMS-13	88
Motor properties of isopropanol, as a fuel for internal combustion engines <i>Kiril Hadjiev</i>	
14. FRI-2.206-1-TMS-14	93
Improvement of the parameters of internal combustion engines when working with biodiesel fuel <i>Atanas Iliev</i>	
15. FRI-2.206-1-TMS-15	99
"GREEN" hydrogen as an alternative to fossil fuels for internal combustion <i>Atanas Iliev</i>	
16. FRI-2.206-1-TMS-16	105
Engine development in virtual environment <i>Ivaylo Borisov, Simeon Iliev</i>	
17. FRI-2.206-1-TMS-17	110
Dimethyl ether applications in compression ignition engines <i>Dimitar Obretenov, Simeon Iliev</i>	
18. FRI-2.206-1-TMS-18	115
Ethanol as an alternative fuel for diesel engines <i>Emil Mitev, Simeon Iliev</i>	